THE MOLLUSCAN FISHERIES

The San Francisco Bay Area undoubtedly possesses the greatest potential of any area in the State for shellfish culture. Ironically, however, clam and oyster fisheries which at one time flourished and were the most valuable in the State, have waned until at the present time clams rarely are taken commercially and oyster culture has largely been abandoned in favor of other more suitable areas.

Packard (1918) described the molluscans in the most detailed investigation ever made of the bottom fauna of San Francisco Bay. His work was part of the U. S. Fish Commission's investigation undertaken during the presence of the U. S. Fisheries Steamer "Albatross" on the Pacific Coast in 1912 and 1913.

The ensuing material (from Packard) will serve to show the relative distribution as well as the more common species of mollusks in the Bay Area:

"The fauna from San Francisco Bay comprises 81 species and varieties, 43 of which are pelecypods, 31 gastropods, and 7 chitons.

"Fifty-nine percent of the species listed below were taken exclusively within San Francisco Bay. This percentage would be somewhat decreased had collections been made along the littoral outside the Golden Gate. Nevertheless the relatively small percentage of forms common to the two contiguous regions is noteworthy. A number of the forms listed below were rarely taken. Such species obviously have little significance in such a study. Therefore, it has seemed advantageous to prepare a list of the more common species.

"The more common or prevalent species may arbitrarily be defined as those that were taken at one-fourth or more of the stations of any given group of stations, as suggested by Sumner et al. (1913, p. 69). In Table [32] the prevalent species for the different divisions of San Francisco Bay are given."

Appendix D contains a list of selected mollusks of the San Francisco Bay Area.

TABLE 32

PREVALENT MOLLUSCAN SPECIES IN SAN FRANCISCO BAY—1912-1913 [1]

Species		San Pablo Bay	South San Francisco Bay	North San Francisco Bay	Entire Bay (quantitative) hauls
Cordium corbis	[*Clinocordium nuttalli*] [2]	–	x	x	x
Macoma balthica	[*Macoma inconspicua*]	x	–	–	–
Macoma inquinata	[*Macoma irus*]	–	–	x	x
Macoma nasuta		x	x	x	x
Mya arenaria		x	x	–	–
Mya californica	[*Cryptomya california*]	x	x	x	x
Mytilus edulis		x	–	x	x
Ostrea lurida		–	x	x	x
Protothaca staminea		–	–	x	–
Schizothaerus nuttalli		–	–	x	–
Thais lamellosa		–	–	x	x
Zirfea gabbi	[*Zirfea pilsbryi*]	–	–	x	x

[1] After Packard (1918).
[2] Scientific names in brackets differ from original publication to conform with the latest taxonomic works.

THE OYSTER FISHERY

Early History

Historically, the native oyster (*Ostrea lurida*), was present in the Bay in prodigious quantities and clams and mussels were plentiful. Townsend (1893) one of the foremost experts of the time on oyster culture, who was sent by the U. S. Fish Commission to make a survey of the oyster fisheries on this coast, reported the following: "There are extensive deposits of this species [native oyster] in the shallow water all along the western part of the Bay, and their dead shells washed ashore by the high seas that accompany the strong winds of the winter season, have formed a white glistening beach that extends from San Mateo for a dozen or more miles southward. So abundant are they that this constantly increasing deposit of shells covers everything along shore and forms bars extending into the Bay.

"Schooners frequently carry away loads of them for the making of garden walks and for other purposes to which oyster shells are adapted. The supply is unfailing."

Current testimony to the existence of these tremendous deposits is found in the recent book *San Francisco Bay* by Harold Gilliam, Doubleday and Company, New York: "The Bay is one of the few places in the world where cement is made from shells and possibly the only place where the shells and the mud exist naturally in almost exactly the right proportions for cement making.

"For more than a quarter of a century this [cement] plant has been fed by the remains of the Bay's ancient oyster populations and it is estimated that the Bay floor is covered with enough shells to continue the operation another 50 years."

Bonnot (1935), who was assigned to the State's oyster investigations in the 1930's, gave the following brief history of the oyster industry from 1870 onward:

"An historical account of the oyster industry of California must deal almost entirely with exotic species. The native oyster has been utilized commercially since the days of the Spaniards but no worthwhile attempt at any form of culture was ever made. The natives were merely taken from the natural beds until the introduction of other and larger species thrust them into the background.

"In recent years the sale of oysters in California has been confined to eastern oysters (*Ostrea virginica*)

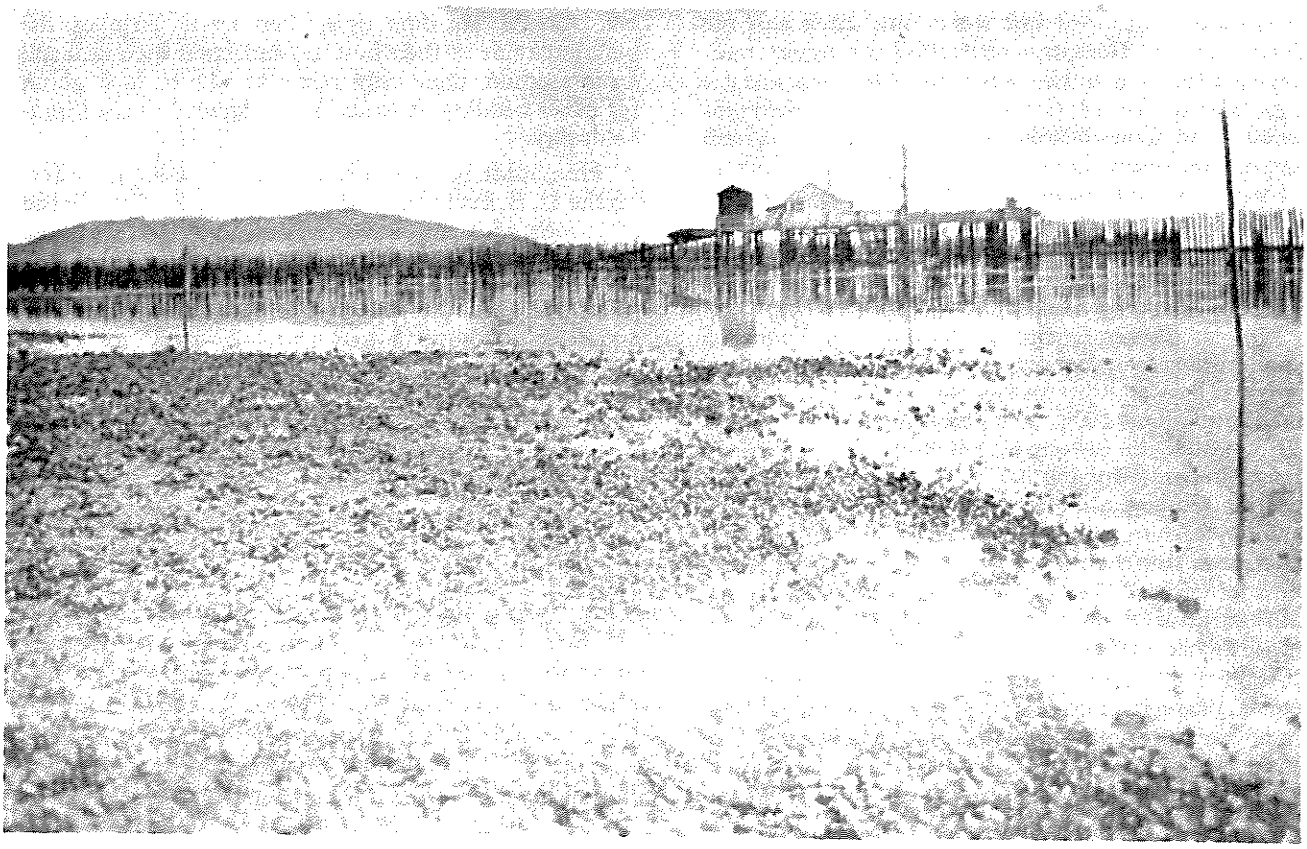
[now *Crassostrea virginica*], shipped market-size and held in San Francisco or Tomales bays, and to Olympia oysters [*Ostrea lurida*] shipped from the state of Washington. There is no particular reason why the California native oyster could not compete favorably with Olympias except that in both California and Washington the old-time oysterman, until very recently, clung to the trial and error method of culture, and natural conditions in the State of Washington have been such that these methods were effective there.

"The first introduction of a foreign oyster on a commercial scale was in 1868 when the Mexican Oyster Company started importing Mexican oysters [*Ostrea irridescens* or *chilensis*] to San Francisco from Altata and Acapulco. The oysters were shipped by steamer and sold at the dock for 25 cents each. A notice was posted several days in advance of the steamer's arrival. This business was not very profitable as many of the oysters died during the trip and in 1870, when the eastern oysters began to be shipped to San Francisco on the newly completed transcontinental railroad, the Mexican company went out of business. Mexican oysters were again imported during 1897-99 by Eli Gordon, of San Francisco but the conditions arising from the Spanish-American War caused him to discontinue the business.

"During 1870 [according to Collins (1892) this oyster shipment came West in 1869] A. Booth [and Company] of Chicago shipped three carloads of eastern oysters to San Francisco. Most of these were sold at once and those remaining were laid out in the bay. Booth sold out to the Morgan Oyster Company in 1871 and passed from the picture.

"The first oyster beds were located at Sausalito, Point San Quentin, Sheep Island [Brooks Island], Oakland Creek and Alameda Creek. These beds were soon abandoned and by 1875 all the beds were located in South San Francisco Bay. In 1872 Corville and Company laid out a bed just south of Point San Bruno. After operating here for several years they sold to Swanberg and West who worked the ground until 1885 when it was absorbed by the Morgan Oyster Company. In 1884 Doane and Company established a bed at North Belmont and the next year sold it to Morgan Oyster Company. In 1877 M. B. Moraghan made a start in the oyster business and controlled several beds, the most important being at Coyote Point, near the Morgan Oyster Company bed. By 1885 we find only two companies engaged in the oyster business; Moraghan with two or three beds and the Morgan Oyster Company controlling six. The Morgan Oyster Company beds at this time were located at Dumbarton, San Bruno, Millbrae, Alvarado, North Belmont, and South Belmont. The Alvarado station was abandoned in 1890 as it was too exposed to strong winds and heavy seas.

FIGURE 33. Moraghan Oyster Establishment 1890. Note the enclosed bed and thickness of the oysters which are exposed at low tide. Photo credit. Report U.S. Commission of Fish and Fisheries for 1889-1891.



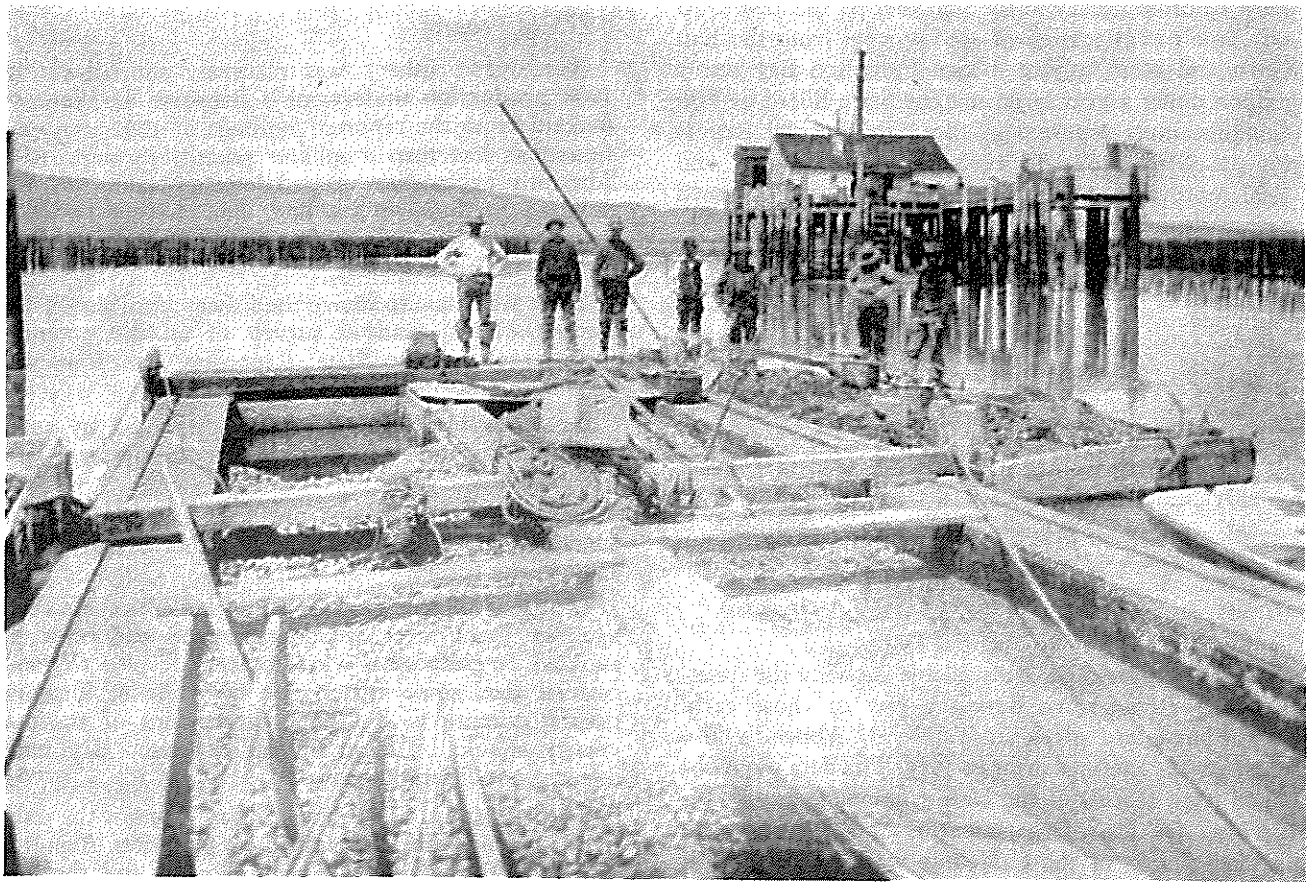
oysters were ever recovered. Humboldt Bay was given up by the oystermen and no attempt was made to do anything more there until 1932.

"Oyster planting in Tomales Bay started at about the same time as that in San Francisco Bay. At Millerton, on the eastern side of the bay, 17 carloads of eastern oysters were laid out by Weinard and Terry, in 1875. They simply held them there and sold as the market permitted until all were disposed of. Easterns were again planted in 1907 by Eli Gordon, who staked several small beds. Gordon later sold his holding to J. McNab and G. Smith, who in turn sold to the Pacific Coast Oyster Company, which still owns the beds and holds eastern and Olympia oysters there. The Consolidated Oyster Company put in a small bed at Blakes Landing in 1917 which is now abandoned."

Townsend (1893) mentions that the beds in Oakland and Alameda Creeks were abandoned because of sewage and traffic on the bay. At the time, he reported the Dumbarton beds as being the best in the Bay. According to him the Moraghan beds occupied 1,100 acres. Those of the Morgan Oyster Company, according to a biennial report of the State Board of Fish Commissioners, were estimated at 1,500 to 2,000 acres at that time.

It is interesting to note the value of oyster lands during this period. The information is from Townsend's report. "These lands [the tidelands of San Francisco Bay], surveyed and sold by the State at $1.25 per acre, have gradually passed into the hands of the larger oyster companies. This is especially true of the extensive flats in the southern part of the Bay, most

FIGURE 35. Large double float with scows, tongs, baskets and other features of the oyster fishery of 1890. M. B. Moraghan Establishment. Photo credit. Report U.S. Commission of Fish and Fisheries, 1890-1891.



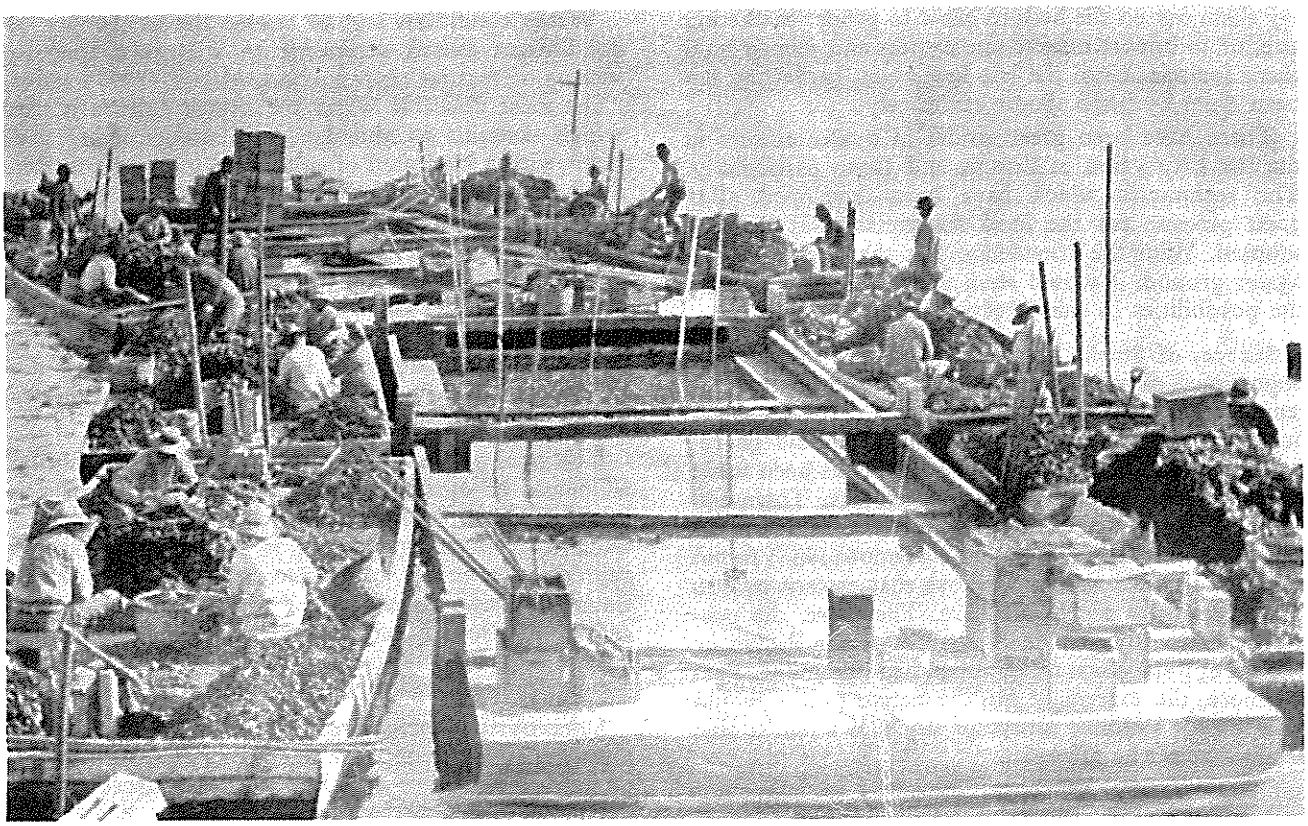


FIGURE 36. Culling oysters 1889-1891 Morgan Oyster Company, Millbrae. Photo credit, Report U.S. Commission of Fish and Fisheries, 1889-1891.

operative program in the 1930's to promote the development of the oyster potential on this coast. The program, which involved a series of surveys and research, provided much of the present knowledge about oyster culture in this State.

The program successfully stimulated the interest of private companies. The Pacific oyster *(Crassostrea gigas)* was imported from Japan in 1931 and beds were established in Drakes, Tomales, and Morro bays. Special efforts were directed toward the cultivation of the native oyster in Humboldt Bay in an attempt to offer a product which would compete with the Olympia or Willapa Bay oyster, which is the same species, grown in Washington.

The results of the program were positive and the state-wide oyster landings began to increase. San Francisco Bay, however, continued to decline as an oyster ground. Only one oyster company persisted on the Bay as late as 1937. The San Francisco Area, nevertheless, up to this time, remained the State's leading oyster producer chiefly because of new beds in Bodega Lagoon, Tomales Bay and Drakes Estero. By 1941 total production in the State reached almost 2 million pounds, mostly Pacific oysters. At this point the war interfered with the importation of seed oysters from Japan and the landings steadily decreased to 272,000 pounds by 1946.

At the cessation of hostilities oyster culture was resumed and imports were again made from Japan. Production gained momentum, until by 1956 over 6 million pounds of oysters were harvested in the State.

Humboldt and Morro bays are now the leading oyster grounds, the former being the largest producer. Of the 6 million pounds harvested in 1956, the San Francisco Area contributed slightly more than 6 percent. Landings for both the Bay Area and those of the entire State are given in Appendix B-2 from 1916 through 1958. Figure 20 compares the State and Bay Area Landings.

There does not exist an oyster sport fishery, as such, in California, although a small quantity of native oysters are taken by sportsmen. The other species have not yet distributed themselves and therefore are found only on cultivated beds.

Oyster Culture

General. Oyster culture necessarily varies, according to the species grown and local conditions. Outside of these variables, there are basic differences in cultural and harvesting techniques. In California, in the past, only the crudest methods have been employed. The practice generally has been to import seed oysters and

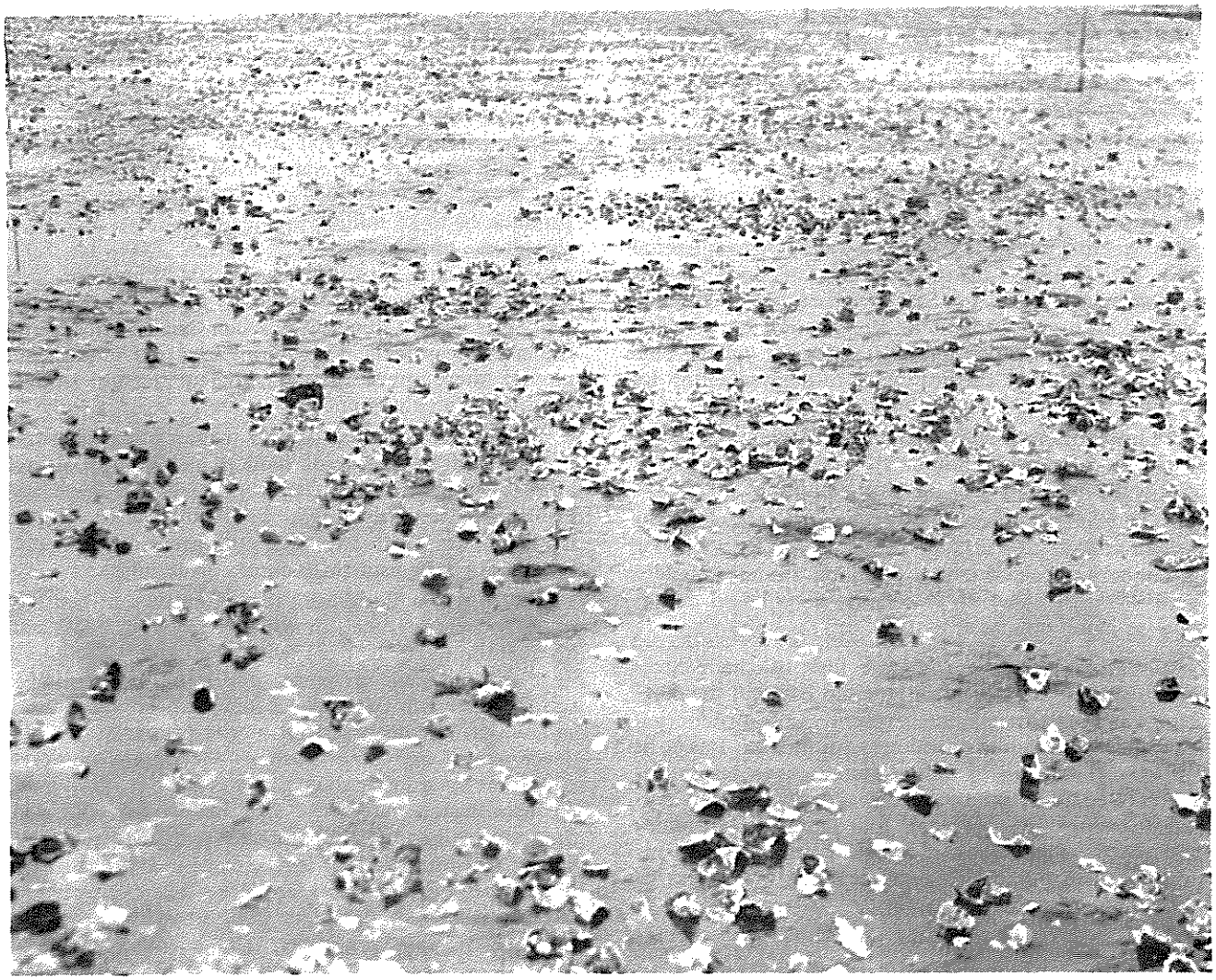


FIGURE 37. Freshly set out Pacific oyster seed on shell. D. F & G. photo by H. G. Orcutt, Jan. 11, 1956.

fish are not a serious problem; they would be almost impossible to exclude.

Oyster drills would undoubtedly cause the greatest losses unless special precautions were taken to protect against them. Presently each shipment of imported oysters is inspected and infested lots are not permitted to be planted. The predations of the drill and starfish both have been largely disposed of in some areas (foreign countries) by the adoption of modern cultural techniques in which the oysters are grown in racks or trays suspended above the bottom. Since both pests are strictly bottom forms, they are thus excluded.

Potential for Oyster Culture in the Bay Area. Knowing most of the esturine waters of the Bay Area are capable of producing oysters and being supplied with quantitative data from previous production records, it is not too difficult to imagine that an oyster fishery of exceptional proportions could be developed here.

There is an unfailing market for oysters and they usually command an excellent price. The quantity grown in California in past years fell far short of the demand and much of the supply had to be shipped in from areas to the north.

Since the end of World War II and the resumption of trade with Japan, Pacific seed oysters have again been imported and highly successful fisheries have been developed in Humboldt and Morro bays and to a lesser extent in the smaller bays in the San Francisco Area. These, however, do not satisfy the present market demand. The apparent solution would seem to lie in an expansion of the industry and; as a matter of fact oyster growers have already shown renewed interest in some of the local oyster lands for the purpose of establishing commercial beds. Some lands have already been allotted to oyster concerns by the Fish and Game Commission for cultural purposes.

TABLE 35

CURRENT OYSTER ALLOTMENTS AND PRIVATE OYSTER BEDS IN THE BAY AREA

Location	Ownership	Acreage	Name of Concern
San Pablo Bay	State Allotment #60	3,000	Clayton McNeil
Tomales Bay	State Allotment #1	387	Coast Oyster Company
Tomales Bay	State Allotment #52	88	Coast Oyster Company
Tomales Bay	State Allotment #34	120	Henry Jensen
Tomales Bay	Private	5*	Spenger
Tomales Bay	Private	10*	Tomales Bay Oyster Co.
Drakes Estero	State Allotment #2	1,165	Coast Oyster Company
Bolinas Lagoon	State Allotment #57	240	Coast Oyster Company
Total Acreage		5,015	

* Estimated.

Coast Oyster Company has also expressed an interest in San Pablo Bay.

Several factors appear to be affecting the development of San Pablo Bay for oyster purposes. Apparently there are few interests willing to invest the capital required to establish the industry on unproven ground, and furthermore, certain areas are restricted by the Department of Public Health. Industrial pollution is serious in some areas.

South San Francisco Bay: At the present time no oyster operations are conducted in the South Bay due to the public health quarantine. The Department of Fish and Game is experimenting with small plants in the vicinity of Palo Alto to observe the growth and condition of oysters planted in this area. The entire South Bay is potentially valuable oyster ground, perhaps the finest in the State. It is proven ground and the only serious factors limiting its use are pollution and public health restrictions.

North San Francisco Bay: Oysters are not grown here at the present time. The North Bay does not appear to have the potential of either the South Bay or San Pablo Bay. Some areas are rather deep for oyster purposes. However, portions with mud bottoms, and the smaller coves and bays along each side, are possibilities. Richardson's Bay, for example, was used as an oyster ground before 1900.

Tomales Bay: This bay has extensive shallow areas well suited to oyster culture. The east side of the bay is most suited to the purpose. The Tomales Bay Oyster Company and the Spenger Oyster Company are currently growing oysters here on private beds. A total of 595 acres has also been allotted by the Fish and Game Commission to oyster interests. This Bay produces fine oysters and the potential is good. A large portion of this Bay, being one of the most productive clam areas in the State, has been set aside as a public clamming area and cannot be alloted for other purposes. Extensive development is also limited because most of the adjacent land is in private ownership.

Bolinas Lagoon: This is another excellent shellfish area. Clamming is superior, but oyster culture has been limited. The Coast Oyster Company has a 240 acre allotment here and has spent two years in developing it. Although operations are still in the exploratory stage, it appears to be a promising producer. The rest of the Lagoon is set aside as a public clamming area.

Drakes Estero: Past experience has shown this site to be a good oyster producer. Formerly, the entire area (about 3,000 acres) was in oyster allotments. At the present time 1,165 acres along the shoreline are reserved for this purpose. The rest has been set aside as a State public clamming area. The Coast Oyster Company is active here and the oysters produced are of excellent quality, entering the trade as half shell and for other specific purposes requiring a first class product. This area can be expected to be developed to the fullest possible extent in the future.

Bodega Bay: Bodega Bay is rather small (about 700 acres) and oyster potential is limited. The only suitable area lies in the south end of the bay where beds formerly existed. It is chiefly a clamming area.

Private Salt Ponds. The use of small acreages of privately owned tidal bottom lands or salt water ponds has not been investigated in California to the writer's knowledge. On the Atlantic Coast, however, some experimental work is being done along these lines, with commercial oyster culture in mind. The U. S. Bureau of Commercial Fisheries has reported the successful setting and growth of eastern oysters in salinities varying from 15 to 27 parts per thousand.

THE CLAM FISHERY

Much of the foregoing enthusiasm about the possibilities of oyster culture in the Bay could appropriately be applied to clams as well. However, there is little doubt that where private enterprise is concerned, efforts at clam culture would be secondary in view of the more lucrative oyster.

Bonnot (1940b) and, more recently, Fitch (1953) have described the common marine bivalves of California. Fitch, in addition, gives a brief but informative account of their habits and habitat, anatomy, locomotion, feeding, growth, reproduction, maturity and ecological relationships.

Introduced species have sustained the clam market in the Bay Area.

Lung Clam Company. Although there are soft shell clams all over Tomales Bay, they can only be found in paying quantities inside this fence."

Bodega Bay. "The whole bottom of Bodega Bay is good clam ground and six or seven species are taken in commercial quantities, including the soft shell. A great many of the clams of all species are used by the local fishermen for bait. None of the bottom is fenced."

TABLE 36

FORMER CLAM BEDS IN THE BAY AREA [1]

Location	Fenced or Unfenced	Acres	Started	Destroyed	Owner
South City	yes	25	1890	....	Maitzner
South City	yes	25	1890	1920	Connell
Bayview	yes	50	1890	1930	Connell
Bayshore	yes	10	1925	1931	Connell
San Leandro Bay	no	100	....	....	Public
Sixteenth Street Oakland	no	150	....	....	Public
Brooks Island	no	50	....	....	Public
Sobrante	no	100	....	....	Public
Wine Haven	no	100	....	....	Public
Cozy Cove	no	40	....	....	Public
Albany	yes	100	1928	....	Quong Sang
Tiburon	yes	3	1930	....	Connell
Tiburon	yes	2	1930	....	Connell
Strawberry Point	yes	3	1930	....	Connell
Tomales Bay	yes	300	1910	....	Pacific Coast Oyster Company
		1,058			

[1] Data from Bonnot 1932.

1915 to Present

With the initiation of the record system in 1915, accurate information on clam landings became available. But the resource had degenerated greatly by then.

Soft-shell clams remained the most important market species in the Bay and as a matter of fact comprised almost the entire catch in Area after 1915. Annual soft-shell landings are shown in Appendix B-2. They were on the order of about 100,000 to 300,000 pounds between 1916 and 1935. The species continued to decrease until they eventually dropped completely out of the commercial picture in 1949. There have been no landings reported since that time. Bay Area landings constituted virtually the entire state-wide total of soft-shell clams.

Pismo and razor clams have been omitted from this discussion since both are rare in the Bay Area. Pismo's were the most important commercial species in the State for a number of years immediately preceding 1920 but, due to pollution and excessive digging, landings dropped below those of soft-shell clams. In California, Pismo clams are found chiefly along the coast of San Luis Obispo County.

For the sake of convenience all clams and mussels other than soft-shell clams have been arbitrarily classified as miscellaneous clams in Appendix B-2. The combined landings of all species in this category rarely

FIGURE 38. Orientals digging soft-shell clams on flats of San Pablo Bay at Pinole about 1920. D. F. & G. photo presumably by F. W. Weymouth.

Washington Clam: The Washington is one of the more important species to sport clam diggers and is especially esteemed as a food mollusk. According to Weymouth "The localities in which they are most markedly abundant are: Humboldt Bay, Crescent City Beach, Bodega Bay, Wilson's Creek, Tomales Bay, Bolinas Bay, and Drakes Estero." Morro Bay is an equally important source of Washington clams. "In Bodega Bay the beds lie in the middle ground exposed by the tides, and along the western shore. In Tomales Bay the beds are neither extensive nor utilized commercially. In Bolinas Bay they are nearly gone, due, it is said, to the deposition of sand. Judging from the fact that at one time the Indians came annually to camp at Tomales Bay in order to gather the Washington clam, they must have been far more abundant then, than at the time [1919] of the survey."

"It is improbable that any further development of an industry based on this clam is to be expected. It is less hardy and of slower growth than *Mya* [soft-shell] and hence less able to withstand excessive fishing."

The shells of this species were formerly used as money among the coast Indians. A heavy valve without discolorations was worth about fifty cents around 1900.

Littleneck Clam: In California the common littleneck clam reaches its greatest abundance in bays such as Humboldt, Bodega and especially Tomales, according to Weymouth. At the time of his survey [1919] he stated that in Bodega Bay it was of sufficient importance to warrant digging commercially for shipment to the San Francisco markets. They are most abundant on the northwestern side of Bodega Bay.

Good beds in Tomales Bay are located on the gravel and boulder beaches.

Quoting Weymouth, "On the northern side of the Bay the best beds are between Marshals and Arroyo San Antonio; on the southern side they lay opposite these and for two miles towards the head of the Bay from Inverness . . ."

Bent-nose Clam: This species is of particular interest because it is the most common and widely distributed species in the State. It is a hardy species, common to sheltered bays and sloughs. It tolerates a great range of water and bottom conditions, but is not common on sand or gravel beaches or in situations where it is exposed to the surf. Weymouth states "It is a hardy species, flourishing under conditions speedily fatal to many other forms."

Although the bent-nose has been used as a food mollusk, they are generally overlooked by most clammers. These are the most common shells found in the Indian shell mounds, indicating they were an important food item to the Indians.

Gaper: With the exception of the geoduck, this is the largest species of clam in California. It may reach a length of eight inches and weigh up to four pounds. They are found in a variety of habitats, except in areas of low salinity, and are fairly abundant at a good many locations along the California coast. In the Bay Area, particularly good locations include Bodega Bay, where they are found on the middle tidelands near the channels; Tomales Bay, between Sand Point and Tom's Point and in association with littleneck clams on the beaches; in Drake's Estero they are found along the eastern spit. Beds are also located along the coast between Bodega and Tomales Bay. The gaper is one of the most important species taken by clammers. It is not particularly favored as a food item in comparison to some of the other species; nevertheless, diggers exploit the available beds fully.

Soft-Shell Clam: The soft-shell is one of the better known food clams. It is widely distributed in all favorable estuaries, bays, and river mouths north of San Francisco. San Francisco Bay, however, is the center of abundance because of the large expanse of favorable habitat. It prefers sheltered bays free from heavy wave action.

Important beds in the Bay area, other than in the Bay itself, are located in Bodega Bay along the eastern shore and the northern end of the western shore, and in Tomales Bay, near the head of the Bay and along the northeastern shore. Beds of lesser importance are found in Drakes Estero and the Estero del Americano.

The beds in Bodega and Tomales Bay offer fair results to sport diggers but would not withstand commercial exploitation. Drake's Estero, being encompassed by private land, is not easily accessible to sport diggers.

The soft-shell clam offers the greatest possibility for cultivation, here as on the Atlantic Coast. The species is hardy, fast growing, and tolerant of variable salinity. San Francisco Bay with its extensive mud flats could support a fair industry were it not for polluted conditions. At the present time, the cost of labor and the initial capital required to fence out predacious sharks and stingrays, are additional factors discouraging clam culture.

Japanese Littleneck Clam: Special mention should be made of this clam because it has become abundantly distributed in San Francisco Bay. It will tolerate very low salinity and a variety of bottoms. It attains a length of about 3 inches and is reported to be an excellent food clam. They are eagerly dug by Bay Area clam enthusiasts.

Sea Mussel: The California sea mussel is taken in fair quantities by clammers. Since it is the species most commonly associated with mussel poisoning, it deserves brief mention in this connection.

During the summer months, June to September, the tiny dinoflagellate *Gonyaulax* becomes very abundant in the ocean and forms a substantial part of the diet of clams and mussels. Contaminated shell fish become

FIGURE 39. Sportsmen searching for abalones along Marin County shoreline. Photo courtesy Marin County Sportsmen's Association.

The Sport Fishery

Abalones are sought intensively by many people in the Bay Area. There is a long open season each year and on a series of minus tides scores of people can be found searching the rocks for them. Most of the easily accessible locations have been pretty well depleted, but fair quantities still exist in the relatively inaccessible areas north of the Golden Gate.

Particularly popular areas along the Bay Area coast include Pillar Point, Montara, and the Marin County coast. In some localities north of Stinson Beach abalone fishing is excellent for the fortunate few who are able to gain access.

General Information

There have been many technical and popular reports written on abalones. Edwards (1913) gave a brief account of the fishery of that time and some historical information. Croker (1931), treated the same subjects but more extensively. Thompson (1920), described the abalones of Northern California and their distributions. Bonnot (1948), in more detail described seven of the eight species, listed their distribution, and also touched briefly on their life history.

Of the eight species found in California four are represented in the ocean off Bay Area counties. The red abalone (*Haliotis rufescens*) is the principal species in both the sport and commercial fisheries. The black abalone (*Haliotis cracherodii*) may be fairly common in some locations, while the green (*Haliotis wallalensis*) and the Japanese (*Haliotis kamtschatkana*) abalones must be considered scarce.

Abalones occupy the intertidal zone from high water to a depth of about 300 feet, though maximum concentrations are found in depths of 25 to 40 feet. Cox (1958) in his investigation disclosed that abalones are particularly sedentary. Tagged animals have been found in the same areas in which they were released two to three years previous. They do not appear to move from one depth to another, although short lateral movements (parallel to shoreline) may occur. None released in water over 20 feet deep have ever been recovered in shallower water.

Spawning takes place in the spring and summer. There is a free floating stage which is estimated to last from 8 to 10 days before the spat drop to the bottom to assume the adult characteristics. Young abalone are found on the underside of rocks and in dark crevices.

Cox, Keith W.
1955 California Abalone, Report of Investigation presented to California Assembly Interim Committee on Fish and Game.
1958 Notes on the California Abalone Fishery, Proceeding of the National Shellfisheries Association. Vol. 48, 1958, pp. 103-109.

Croker, Richard S.
1931 Abalones. In: The Commercial Fish Catch of California for the Year 1929. California Division of Fish and Game, Fish Bulletin No. 30, pp. 58-72.

Davis, H. C.
1953 On food and feeding of larvae of the American Oyster, *Crossostrea virginica*. Biol. Bull. 104, p. 334.

Dean, Bashford
1892 The phsyical and biological characteristics of the natural oyster grounds of South Carolina. U. S. Fish. Comm. Bull. 10, p. 335.

Edmondson, Charles H.
1922 Shellfish Resources of the Northwest Coast of the United States. U. S. Department of Commerce, Bureau of Fisheries, Bureau of Fisheries Document No. 920.

Edwards, Charles Lincoln
1913 The Abalone Industry in California. California Division of Fish and Game, Fish Bulletin No. 1, pp. 5-15.

Ellis, M. M.
1931 Some factors affecting the replacement of the commercial fresh-water mussels. U. S. Bur. Fisheries, Fishery Cir. 7.

Fielder, R. H.
1936 The Story of Oysters. U. S. Department of Commerce, Bureau of Fisheries, Fishery Circular No. 21.

Fisher, John P.
1916 Clams in San Francisco Bay
California Fish and Game, Vol. 2, No. 4, pp. 209-210.

Fitch, John E.
1953 Common Marine Bivalves of California
California Department of Fish and Game, Fish Bulletin No. 90.

Galtsoff, P. S., H. F. Prytherch, and H. C. McMillin
1930 An Experimental Study in Production and Collection of Seed Oysters, U.S. Department of Commerce, Bureau of Fisheries, Fisheries Document No. 1088.

Heath, Harold
1913 Investigation of the Clams of California
California Division of Fish and Game, Fish Bulletin No. 1.
1916 California Clams
California Fish and Game, Vol. 2, No. 4, pp. 175-178.

Hill, C. L. and C. A. Kofoid, Editors in Chief
1927 Marine Borers and their Relation to Marine Construction of the Pacific Coast, Final Report of the San Francisco Bay Marine Piling Committee
San Francisco Bay Marine Piling Committee, San Francisco.

Kellogg, James L.
1905 Conditions governing existence and growth of the soft clam, U.S. Comm. Fish and Fisheries Report 194.

Korringa, P.
1952 Recent advances in oyster biology, I. Quarterly review of Biology 27, p. 266.

Loosanoff, B. L. and F. D. Tommers
1947 Effect of low pH upon rate of water pumping of oysters, Anatomical Record, 99; 4, pp. 112-113.

Lunz, G. R., Jr.
1938 Effects of flooding of the Santee River in April 1936, on oysters in the Cape Romain Area of South Carolina. Part II, U.S. Engineer's Office, Charleston, S. C.

McMillin, H. C. and Paul Bonnot
1931 Oyster Culture in California
California Fish and Game, Vol. 17, No. 3, pp. 246-251.
1932 Oyster Pests in California
California Fish and Game, Vol. 18, No. 2, pp. 147-148.

Medcof, J. G., and A. W. H. Needler
1941 The influence of temperature and salinity on the conditions of oysters, Jour. Fish Res. Rd. Canada 5, No. 3, p. 253.

Mitchell, P. H.
1914 The oxygen requirements of shellfish, Bull. U.S. Bur. of Fisheries 32, p. 207.

Moore, H. F.
1897 Oysters and Methods of Oyster Culture with Notes on Clam Culture, U.S. Commission of Fish and Fisheries, Government Printing Office, Washington, D. C.

Oliveira, L. P. H., de
1924 Annotated Bibliography of oysters, Rept. U.S. Comm. Fish. Doc. 966.

Orcutt, H. G.
1956 Oysters
Outdoor California, Vol. 17, No. 5
California Department of Fish and Game.

Packard, E. L.
1918 The Molluscan Fauna from San Francisco Bay
University of California Publications in Zoology, Vol. 14, No. 2, University of California Press, Berkeley.

Phillips, J. B.
1934 Octopi of California
California Fish and Game, Vol. 20, No. 1, pp. 20-29.

Rankin, Edward P.
1918 The Mussels of the Pacific Coast
California Fish and Game, Vol. 4, No. 3, pp. 113-117.

Scofield, N. B.
1930 Conservation Laws Provide Ample Protection for Abalones
California Fish and Game, Vol. 16, No. 1, pp. 13-15.

Smith, F. G. W. and H. Chapin
1954 The Sun, the Sea and Tomorrow, Charles Scribner's Sons, New York, New York.

Sommer, H., K. F. Myer, W. F. Whedon, and C. A. Kofoid
1936 Mussel poisoning, 2d Inst. Congr. Microb.; Water Pollution Abs. 9, November (1936).

Tartar, Vance
Washington Oysters
State of Washington, Department of Fisheries, 5 pp. mimeo.

Thompson, Will F.
1920 The Abalones of Northern California
California Fish and Game, Vol. 6, No. 2, pp. 45-50.

Townsend, Charles H.
1893 Report of Observations Respecting the Oyster Resources and Oyster Fishery of the Pacific Coast of the United States, U.S. Commission of Fish and Fisheries Report 1889-91.
U.S. Government Printing Office, Washington, D. C.

Tressler, D. K.
1923 The California Abalone Industry
Marine Prods. of Comm. The Chemical Catalog Company, N. Y., pp. 615-618.

Truitt, R. V.
1946 Maryland oyster situation, Maryland Tidewater News, September 1946.